

TECHNICAL DATA

LeCroy



CAMAC Model 2249A

12-Channel A-to-D Converter

FEATURES:

- **COMPACT PACKAGING**
12 channels per single-width module means fewer crates, smaller systems, less gate fan-out.
- **WELL-CONTROLLED PEDESTAL**
Advanced hybrid circuit front end eliminates peak shifts and/or constant calibration.
- **EXCELLENT INPUT IMPEDANCE MATCH**
Minimizes possibility of digitizing input reflections.
- **10-BIT RESOLUTION**
One part in 1024.
- **WIDEST DYNAMIC RANGE**
4 times the range of 8-bit ADC's allows broader spectra, better accuracy, simplified setup, prevents small gain shifts from exceeding range of ADC.
- **HIGH SENSITIVITY**
0.25 picocoulomb per count.
- **NO FEEDTHROUGH**
Up to 1,000-fold overloads are rejected by fast gate, eliminating spurious data due to out-of-time chamber firings, noise, etc.
- **UNIFORM SENSITIVITY THROUGHOUT GATE INTERVAL**
No modulation of measurement with position of signal within gate.
- **NO INTERCHANNEL CROSSTALK**
regardless of input amplitude.
- **WELL-VENTILATED MODULE**
Low component count, less than one-fifth of competing designs, permits free circulation of air for cooler, more reliable, and longer-lasting operation.
- **FAST CLEAR INPUT**
enables fast rejection of unwanted data.
- **FULL TEST CAPABILITY**
F(25) simultaneously injects charge into all ADC's proportional to DC level on front panel (or patch pins on Dataway).
- **FULL LAM FUNCTIONS.**
- **HIGH DIGITIZING SPEED**
without sacrifice in differential linearity.
- **LAM AND Q SUPPRESSION**
eliminates readout of empty modules.

The LRS Model 2249A 12-Channel Analog-to-Digital Converter is a higher performance and more compact version of the world's most widely used integrating ADC, the LRS Model 2248. It embodies all the operational characteristics which have proved important for general-purpose use in high energy particle physics, including expanded resolution (0.1%), higher sensitivity, excellent stability, faster digitizing rate, LAM and Q suppression, provision for fast clear, calibrating test mode, and flexible LAM options.

These ADCs are specifically intended for use in demanding applications such as particle identification using dE/dx counters, recording x-ray, neutron, or recoil proton energies using lead glass or other total energy absorption counters, improving time resolution by correcting for slewing due to variances in counter output amplitudes, monitoring gas threshold Cerenkov counters, and debugging or monitoring proportional or drift chambers.

The Model 2249A contains twelve complete ADC's in a single-width CAMAC module. Each ADC offers a resolution of ten bits to provide 0.1% resolution over a wide 1024-channel dynamic range. The factor of 4 wider range allows operations with broad signal spectra such as are encountered in experiments anticipating fractionally charged particles or covering extensive energy ranges. It also greatly reduces the necessity for careful adjustment of signal strengths to match the limited range of an 8-bit, 256-channel instrument. The input sensitivity of the Model 2249A is 0.25 pC/count for a full-scale range of 256 pc. This is compatible with most available signal sources and no additional buffering or reshaping of any kind is required to digitize nanosecond pulses.

The excellent long-term stability, temperature characteristics, and isolation between ADC channels assure accurate and reliable performance under the demanding conditions encountered in actual experiments. Confirmation of operation and calibration is provided by the unique test feature which allows all twelve ADC's or an entire system to simultaneously digitize a charge proportional to a dc level provided to a front-panel Lemo connector or patched into P₁, P₂ or P₅ of the Dataway connector.

The Model 2249A offers excellent event rate capability through the incorporation of a fast clear and a fast digitizing rate. The fast clear input enables the ADC to begin digitizing on the command of a prompt gate and be reset, if necessary, before the end of conversion on the basis of delayed logic or chamber information. This feature eliminates the long input delay cables now required in these situations.

End of conversion of modules which contain data is flagged by generation of a CAMAC LAM. Readout of modules which do not contain information can be eliminated either by use of the LAM signals or through Q suppression.

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Innovators In Instrumentation

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SPECIFICATIONS

Model 2249A

12-CHANNEL ADC

Analog Inputs:	Twelve; Lemo-type connectors; charge-sensitive (current-integrating); direct-coupled, quiescently at approximately +4 mV; 50 Ω impedance; linear range normally -2 mV to -1 V; protected to ± 50 volts against 1 μ sec transients.
Full-Scale Range:	256 pC.
Full-Scale Uniformity:	$\pm 5\%$.
Integral Non-linearity:	$\pm .25\%$ of reading ± 0.5 pC. Set of linearity curves for all channels supplied with each unit. (See graph below.)
ADC Resolution:	10 bits actual, (0.1%).
Long-Term Stability:	Better than 0.25% of reading ± 0.5 pC/week (at constant temperature).
Temperature Coefficient:	Typical, 0; max., $\pm [.03\%$ of reading (in pC) $+ .002t$] pC/ $^{\circ}$ C (where t = gate duration in nanoseconds, with 50 Ω reverse termination).
ADC Isolation:	A 5-volt, 20 ns overload pulse in any one ADC disturbs data in any other ADC by no more than 0.25 pC.
Gate Input:	One gate common to all ADC's; LEMO-type connectors; 50 Ω impedance; -600 mV or greater enables; minimum duration, 10 ns; maximum recommended duration, 200 ns (actual limit approximately 2 microseconds with reduced accuracy; partial analog input must occur within 0.5 μ sec after opening gate to preserve accuracy); effective opening and closing times: 2 ns; internal delay, 2 ns.
Fast Clear:	One front-panel input common to all ADC's; LEMO-type connector; 50 Ω impedance; -600 mV or greater clears, minimum duration, 50 ns. (Caution: narrower pulses cause partial clearing.) Requires additional 2.0 μ s settling time after clear.
Residual Pedestal:	Typically 1 + 0.03t picocoulombs (where t = gate duration in nanoseconds) with 50 Ω reverse termination.
Test Function:	With CAMAC I present, the positive DC level applied to front panel "Test" input (internal high impedance connection to +12 volts) or optional rear connector P1, P2, or P5 patch points will inject charge with a proportionality constant of -12.5 pC/volt into all inputs at F(25) \bullet S2 time. (With CAMAC I not present, F(25) \bullet S2 will generate the ≈ 80 ns gate only, providing a measure of residual pedestal only.)
Digitizing Time:	60 μ s. By factory option, 8-bit operation at 12.5 μ s digitizing time may be provided.
Readout Time:	Readout may proceed at the fastest rate permitted by the CAMAC standard after digitization is complete.
Readout Control:	Ready for readout when LAM signal appears. Refer to ESONE Committee Report EUR4100e and EUR4600e for additional timing details, voltages, logic levels, impedances, and other standards.
Data:	The proper CAMAC function and address command normally gates the 10 binary bits plus overflow bit of the selected channel onto the R1 to R11 (2^9 to 2^{10}) Dataway bus lines.
CAMAC Commands:	Z or C: ADC's and LAM are cleared by the CAMAC "Clear" or "Initialize" command; requires S2. I: Gate input is inhibited during CAMAC "Inhibit" command. (Test Function is enabled.) Q: A Q=1 response is generated in recognition of an F(0) or F(2) Read function or an F(8) function if LAM is set for a valid "N" and "A", but there will be no response (Q=0) under any other condition. The Q response for empty modules can be suppressed. (See Q and LAM suppression.) X: An X=1 (Command Accepted) response is generated when a valid F, N, and A command is generated. L: A Look-At-Me signal is generated from end of conversion until a module Clear or Clear LAM. LAM is disabled for the duration of N, can be permanently enabled or disabled by the Enable and Disable function command, and can be tested by Test LAM. Standard option causes LAM to be suppressed for empty modules.
CAMAC Function Codes:	F(0): Read registers; requires N and A, A(0) through A(11) are used for channel addresses. F(2): Read registers and Clear module and LAM; requires N and A; (Clears on A(11) only.) F(8): Test Look-At-Me; requires N and any A from A(0) to A(11) independent of Disable Look-At-Me. Q response is generated if LAM is set. F(9): Clear module and LAM; requires N, S2, and any A from A(0) to A(11). F(10): Clear Look-At-Me; requires N, S2, and any A from A(0) to A(11). F(24): Disable Look-At-Me; requires N, S2, and any A from A(0) to A(11). F(25): Test module; requires N, S2, and any A from A(0) to A(11). F(26): Enable Look-At-Me; requires N, S2, and any A from A(0) to A(11). Remains enabled until Z or F(24) applied. Caution: The state of the LAM mask will be arbitrary after power turn-on.
Q and LAM Suppression:	Adjustable potentiometer (accessed from side of module) sets count level required (from 0 to 100) before data is considered useful. A module in which all channels contain less than set amount will produce no Q-response or LAM and appears during readout as an empty CAMAC slot, thus reducing readout time. A Command Accepted response is still generated. The LAM suppress portion can be disabled with a solder jumper option.
Packaging:	In conformance with CAMAC standard for nuclear modules (ESONE Committee Report EUR4100e). RF shielded CAMAC #1 module.
Current Requirements:	+24 V at 35 mA; -24 V at 15 mA; +6 V at 850 mA; -6 V at 200 mA.

